

Notice of Allowability	Applicati n No.	Applicant(s)
	09/862,524	FRANZ ET AL.
	Examiner	Art Unit
	Mohammad Ali	2167

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address--

All claims being allowable, PROSECUTION ON THE MERITS IS (OR REMAINS) CLOSED in this application. If not included herewith (or previously mailed), a Notice of Allowance (PTOL-85) or other appropriate communication will be mailed in due course. **THIS NOTICE OF ALLOWABILITY IS NOT A GRANT OF PATENT RIGHTS.** This application is subject to withdrawal from issue at the initiative of the Office or upon petition by the applicant. See 37 CFR 1.313 and MPEP 1308.

1. This communication is responsive to September 13, 2004.
2. The allowed claim(s) is/are 1-14 and 16-22 (Renumbered as 1-21).
3. The drawings filed on 02 April 2004 are accepted by the Examiner.
4. Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
 - a) All
 - b) Some*
 - c) None
 of the:
 1. Certified copies of the priority documents have been received.
 2. Certified copies of the priority documents have been received in Application No. _____.
 3. Copies of the certified copies of the priority documents have been received in this national stage application from the International Bureau (PCT Rule 17.2(a)).

* Certified copies not received: _____.

Applicant has THREE MONTHS FROM THE "MAILING DATE" of this communication to file a reply complying with the requirements noted below. Failure to timely comply will result in ABANDONMENT of this application.
THIS THREE-MONTH PERIOD IS NOT EXTENDABLE.

5. A SUBSTITUTE OATH OR DECLARATION must be submitted. Note the attached EXAMINER'S AMENDMENT or NOTICE OF INFORMAL PATENT APPLICATION (PTO-152) which gives reason(s) why the oath or declaration is deficient.
6. CORRECTED DRAWINGS (as "replacement sheets") must be submitted.
 - (a) including changes required by the Notice of Draftsperson's Patent Drawing Review (PTO-948) attached
 - 1) hereto or 2) to Paper No./Mail Date _____.
 - (b) including changes required by the attached Examiner's Amendment / Comment or in the Office action of Paper No./Mail Date _____.

Identifying indicia such as the application number (see 37 CFR 1.84(c)) should be written on the drawings in the front (not the back) of each sheet. Replacement sheet(s) should be labeled as such in the header according to 37 CFR 1.121(d).
7. DEPOSIT OF and/or INFORMATION about the deposit of BIOLOGICAL MATERIAL must be submitted. Note the attached Examiner's comment regarding REQUIREMENT FOR THE DEPOSIT OF BIOLOGICAL MATERIAL.

Attachment(s)

1. Notice of References Cited (PTO-892)
2. Notice of Draftsperson's Patent Drawing Review (PTO-948)
3. Information Disclosure Statements (PTO-1449 or PTO/SB/08),
Paper No./Mail Date _____
4. Examiner's Comment Regarding Requirement for Deposit
of Biological Material
5. Notice of Informal Patent Application (PTO-152)
6. Interview Summary (PTO-413),
Paper No./Mail Date 01/22/2005.
7. Examiner's Amendment/Comment
8. Examiner's Statement of Reasons for Allowance
9. Other _____.



Mohammad Ali
Primary Examiner
Art Unit: 2167

DETAILED ACTION

1. This communication is in response to the application filed on September 13, 2004.

After a search and a thorough examination of the present application and in light of the prior art made of records, claims 1-14 and 16-22 are allowed.

Election/Restrictions

2. Restriction to one of the following inventions is required under 35 U.S.C. 121:
 - I. Claims 1-14 and 16-22 are drawn to a method indexing the database in the form on a non-negative index matrix, classified in class 707, subclass 7.
 - II. Claims 15 is drawn to apply a formula for a data structure of a function of the number of occurrences, classified in class 707, subclass 101.

The inventions are distinct, each from the other because of the following reasons: Inventions in Groups I and II are related as subcombinations disclosed as usable together in a single combination. The subcombinations are distinct from each other if they are shown to be separately usable. In the instant case, invention in Group I has separate utility such as to a method indexing the database in the form on a non-negative index matrix. See MPEP § 806.05(d). Invention in Group II has separate utility and apply a formula for a data structure of a function of the number of occurrences.

Because these inventions are distinct for the reasons given above and have acquired a separate status in the art as shown by their different classification, restriction for examination purpose as indicated is proper.

During a telephone conversation with Attorney, Aniket Patel (Reg. No. 55,525) on January 21, 2005 a provisional election was made with traverse to prosecute the invention of a method indexing the database in the form on a non-negative index matrix, claims 1-14, and 16-22. Affirmation of this election must be made by applicant in replying to this Office action. Claim 15 is withdrawn from further consideration by the examiner, 37 CFR 1.142(b), as being drawn to a non-elected invention.

EXAMINER'S AMENDMENT

3. An examiner's amendment to the record appears below. Should the changes and/or additions be unacceptable to applicant, an amendment may be filed as provided by 37 CFR 1.312. To ensure consideration of such an amendment, it MUST be submitted no later than the payment of the issue fee.

Authorization for this examiner's amendment was given in a telephone interview with Attorney, Aniket Patel (Reg. No. 55,525) on January 21, 2005.

Please Amend the claims which was filed on April 02, 2004 as,

In claim 1,

Please replace the claim 1 with the new version as,

1. A computer based method of indexing a database of documents, comprising:

providing a vocabulary of n terms;

indexing the database in the form of a non-negative $n \times m$ index matrix V ,

wherein:

m is equal to the number of documents in the database;

n is equal to the number of terms used to represent the database; and

the value of each element v_{ij} of index matrix V is a function of the number of occurrences of the i^{th} vocabulary term in the j^{th} document; and

factoring out non-negative matrix factors T and D such that

$V \approx TD$, wherein T is an $n \times r$ term matrix, D is an $r \times m$ document matrix, $r < nm/(n+m)$, and r is a rank factorization, and

wherein the factorization matrices T and D are a compressed version of the index matrix V .

In claim 13,

Please replace the claim 13 with the new version as,

13. A computer based method of indexing a database of documents, comprising:

providing a vocabulary of n terms;

indexing the database in the form of a non-negative $n \times m$ index matrix V ,

wherein:

m is equal to the number of documents in the database;

n is equal to the number of terms used to represent the database; and

the value of each element v_{ij} of index matrix V is a function of the number of occurrences of the i^{th} vocabulary term in the j^{th} document;

factoring out non-negative matrix factors T and D such that

$V \approx TD$,

selecting a cost function and associated update rules from the group:

$$\text{cost function } F = \sum_{i=1}^n \sum_{j=1}^m [V_{ij} \log(TD)_{ij} - (TD)_{ij}] \quad \text{associated with}$$

$$\text{update rules } T_{ik} \leftarrow T_{ik} \sum_j \frac{V_{ij}}{(TD)_{ij}} D_{kj}, \quad T_{ik} \leftarrow \frac{T_{ik}}{\sum_i T_{ik}}, \text{ and } D_{kj} \leftarrow D_{kj} \sum_i T_{ij} \frac{V_{ij}}{(TD)_{ij}},$$

Art Unit: 2167

$$F = \sum_{i=1}^n \sum_{j=1}^m \left[V_{ij} \log \frac{V_{ij}}{(TD)_{ij}} - (V_{ij}) + (TD)_{ij} \right] \text{ associated with update}$$

cost function

$$D_{kj} \leftarrow D_{kj} \frac{\sum_i \frac{T_{ik} V_{ij}}{(TD)_{ij}}}{\sum_l T_{lk}} \quad \text{and} \quad T_{ik} \leftarrow T_{ik} \frac{\sum_j \frac{D_{kj} V_{ij}}{(TD)_{ij}}}{\sum_h D_{kh}}, \text{ and}$$

rules

$$\|V - TD\|^2 = \sum_{i=1}^n \sum_{j=1}^m (V_{ij} - (TD)_{ij})^2 \text{ associated with update rules}$$

cost function

$$D_{kj} \leftarrow D_{kj} \frac{(T^T V)_{kj}}{(T^T TD)_{kj}} \quad \text{and} \quad T_{ik} \leftarrow T_{ik} \frac{(VD^T)_{ik}}{(TDD^T)_{ik}}, \text{ and}$$

wherein T is an $n \times r$ term matrix, D is an $r \times m$ document matrix, $r < nm/(n+m)$, and r is a rank factorization; and

iteratively calculating said update rules so as to converge said cost function toward a limit until the distance between V and TD is reduced to or beyond a desired value.

In claim 14,

Please replace the claim 14 with the new version as,

14. A program storage device readable by machine, tangibly embodying a program of instructions executable by the machine to perform method steps for indexing a database of documents, said method steps comprising:

providing a vocabulary of n terms;

indexing the database in the form of a non-negative $n \times m$ index matrix V ,

wherein:

m is equal to the number of documents in the database;

n is equal to the number of terms used to represent the database; and
the value of each element v_{ij} of index matrix V is a function of the number of
occurrences of the i^{th} vocabulary term in the j^{th} document; and
factoring out non-negative matrix factors T and D such that
 $V \approx TD$, wherein T is an $n \times r$ term matrix, D is an $r \times m$ document matrix, $r < nm/(n+m)$, and r is
a rank factorization.

Please cancel claim 15.

In claim 16,

Please replace the claim 16 with the new version as,

16. A computer based method of information retrieval, comprising:
 - providing a query comprising a plurality of search terms;
 - providing a vocabulary of n terms;
 - performing a first pass retrieval through a first database representation and scoring m retrieved documents according to relevance to said query;
 - executing a second pass retrieval through a second database representation and scoring documents retrieved from said first pass retrieval so as to generate a final relevancy score for each document; and
 - wherein said second database representation comprises an $r \times m$ document matrix D , such that

$$V \approx TD$$

wherein T is an $n \times r$ term matrix, and r rank factorization;

V is a non-negative $n \times m$ index matrix, wherein each of its m columns represents an j^{th} document having n entries containing the value of a function of the number of occurrences of a i^{th} term of said vocabulary appearing in said j^{th} document; and

wherein T and D are non-negative matrix factors of V and $r < nm/(n+m)$; and

wherein each of the m columns of said document matrix D corresponds to said j^{th} document.

In claim 22,

Please replace the claim 22 with the new version as,

22. A program storage device readable by machine, tangibly embodying a program of instructions executable by the machine to perform method steps for information retrieval, said method steps comprising:

providing a query comprising a plurality of search terms;

providing a vocabulary of n terms;

performing a first pass retrieval through a first database representation and scoring m retrieved documents according to relevance to said query;

executing a second pass retrieval through a second database representation and scoring documents retrieved from said first pass retrieval so as to generate a final relevancy score for each document; and

wherein said second database representation comprises an $r \times m$ document matrix D , such that

$$V \approx TD$$

wherein T is an $n \times r$ term matrix, and r is a rank factorization;

V is a non-negative $n \times m$ index matrix , wherein each of its m columns represents an j^{th} document having n entries containing the value of a function of the number of occurrences of a i^{th} term of said vocabulary appearing in said j^{th} document; and

wherein T and D are non-negative matrix factors of V and $r < nm/(n+m)$; and

wherein each of the m columns of said document matrix D corresponds to said j^{th} document.

Reason for Allowance

4. The prior art made of records does not teach or fairly suggest the combination of elements as recited in each of Applicant's claims 1, 13, 14, 16 and 22. More specifically, prior art of records does not teach or fairly suggests the steps of wherein as argued by applicant's. The dependent claims, being definite, further limiting, and fully enabled by the specification and are also allowed.

Any comments considered necessary by applicant must be submitted no later than the payment of the issue fee and, to avoid processing delays, should preferably accompany the issue fee. Such submissions should be clearly labeled "Comments on Statement of Reasons for Allowance."

Contact information

5. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Mohammad Ali whose telephone number is (571) 272-4105. The examiner can normally be reached on Monday-Thursday (7:30 am-6:00 pm).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, John E Breene can be reached on (571) 272-4107. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Mohammad Ali
Mohammad Ali
Primary Examiner
Art Unit 2167

MA
January 22, 2005